THE DISTRIBUTION PATTERN OF HYDROZOA ON SEAWEED WITH SOME NOTES ON THE SO-CALLED COACTION AMONG HYDROZOAN SPECIES

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THE DISTRIBUTION PATTERN OF HYDROZOA ON SEAWEED WITH SOME NOTES ON THE SO-CALLED COACTION AMONG HYDROZOAN SPECIES[1),2)]

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The well developed marine plant community, composed of sargassum or of the marine flowering plants such as *Sargassum* spp. or *Zostera marina*, is found commonly extending from the tidal zone into the subtidal zone in the neighbourhood of the Asamushi Marine Biological Station of the Tôhoku University in Aomori Prefecture.

For the past several years the writers have been interested in the ecology of the marine animals appearing in the said marine plant community. On the other hand, Hirai and Kakinuma have studied the life history of various Hydrozoan species and the taxonomics of the same kinds of animals (Hirai 1958, 1960; Hirai and Kakinuma 1957, 1960), so the writers felt a special interest in the population ecology of Hydrozoan species in the marine plant community.

Hydrozoan species hitherto found on the seaweed are as follows: *Sertularella miurensis*, *Campanularia* sp., *Orthopyxis platycarpa*, *Obelia dichotoma*, *Obelia geniculata*, *Clytia volubilis*, *Bougainvillia* sp. and *Coryne uchidai*. The former six species belong to Thecata and the latter two to Athecata.

It is recognized that along the coast of Asamushi and its neighbourhood the marine plant communities having respectively characteristic composition seem to be accompanied with their own peculiar Hydrozoan fauna. But regarding the general survey of the Hydrozoan fauna it seems that much remains to be done. In

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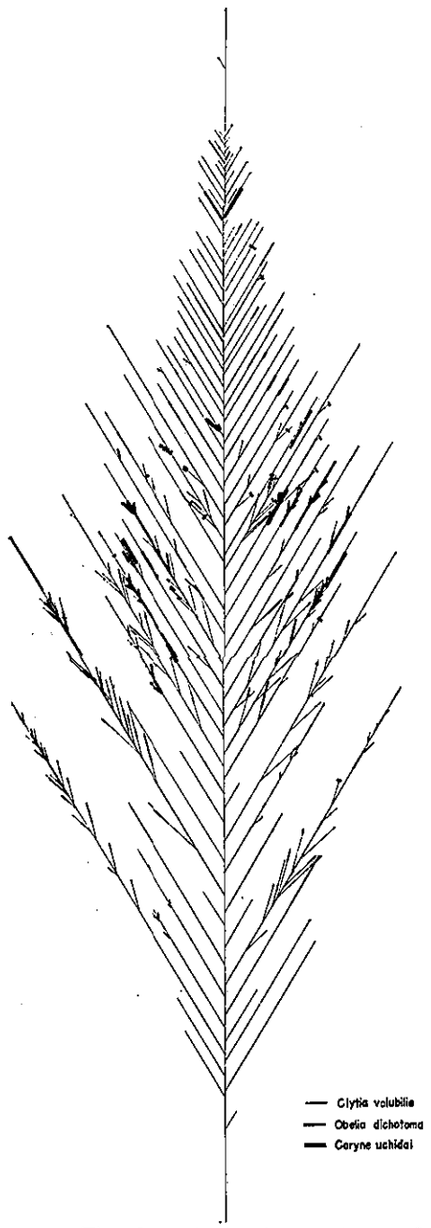

Fig. 1. Distribution patterns of various hydrozoan species on *Sargassum fulvellum*.

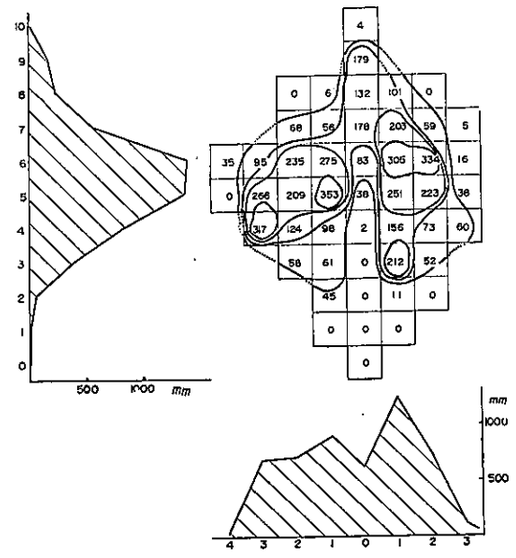

Fig. 2. Distribution of hydrozoa on *Sargassum fulvellum* represented schematically by the quadrate method with the vertical summation curve at the bottom and the horizontal one at the left. Numerals in quadrate and on ordinate of summation curve show the colony size illustrated in the text.

the present paper the distribution patterns of Hydrozoan species on the seaweeds are dealt with.

RESULTS OF OBSERVATIONS AND DISCUSSION

I. Several stumps of *Sargassum fulvellum* were obtained from the sargassum community along the coast of Oura near Asamushi.

The stem of *Sargassum* arises from the discoidal root and rather long alternated branches spread outwards and therefore the external appearance of the plant is spindle shaped.

The hydroid colonies on the plant were examined by a binocular microscope

and the length of the part of stem or branch about which the hydrorhyza adhered was measured as the indicator of the size of the hydroid colony.

Thus the obtained distribution patterns of various hydrozoan species were represented schematically in Fig. 1 in which every branch was, as a matter of convenience, alternately put in two sides, right and left sides.

It seems from Fig. 1 that the hydroid colony distributes generally on the peripheral portion of the plant. In each species, *Clytia volubilis* tends to attach widely on the plant, but *Obelia dichotoma* appears rather densely at a definite stratum.

In order to inquire into these distribution patterns in detail, the so-called quadrate method was used. Namely the sections (20 cm×20 cm) were given by two dimensional components, the distance from the proximal end of the stem and that from the same of the branch. The relative density of the hydroid colony in each section was represented by the total length of the part of branch around which the hydrorhyza had adhered.

The results are shown in Fig. 2.

As is shown in Fig. 2, in relation to the density gradation the stratification appears corresponding to the spindle shaped form of the plant and on the other hand the vertical stratification is also recognized.

These two different gradations in the colony density are also conjectured from the horizontal and vertical summations of the measured lengths of the colonies.

Now, the following is known on each species.

Obelia dichotoma distributes densely in the rather peripheral portion of a

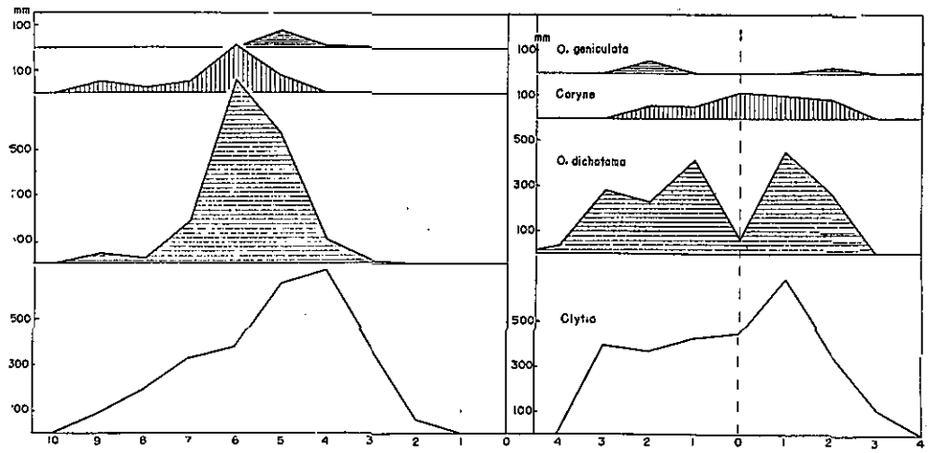

Fig. 3. Polygons showing the vertical (right) and horizontal (left) summations of the colonies of each constituent species. Numeral on ordinate shows the colony size illustrated in the text.

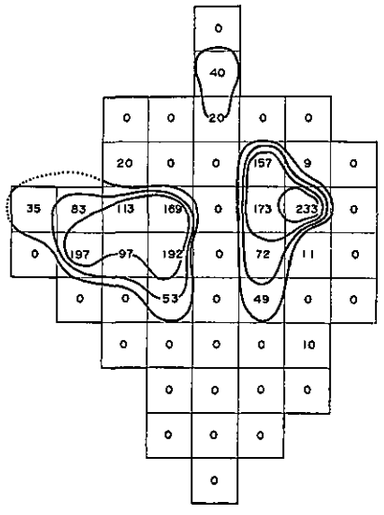

Fig. 4. Distribution of *Obelia dichotoma* represented schematically by the quadrate method.

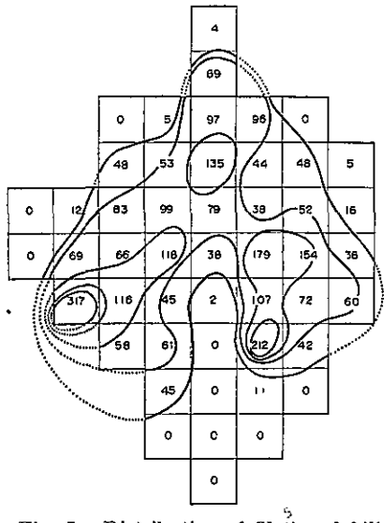

Fig. 5. Distribution of *Clytia volubilis* represented schematically by the quadrate method.

definite stratum in the vertical stratifiication and thus the bimodal distribution appears in the vertical summation curve and the unimodal one in the horizontal one and therefore the densely distributing portion of this species forms a ring at a certain layer in the vertical stratification (Figs. 3 & 4).

But *Clytia volubilis* differs from the above : namely it is recognized from Figs. 3 & 5 that though the colony is at the rather peripheral portion of the plant the gradation in the vertical dsitribution is not so conspicuous as that of the above species and even in the vertical summation curve the bimodal distribution scarcely appears and therefore the distribution pattern shows generally the gradation stratified corresponding to the spindle like form of the plant.

As is mentioned above, each species shows respectively a chracteristic distribution pattern affording some ecological interest with regard to the relation between the environmental condition and the attaching situation of larvae or the growth of the colony.

Now, it is noted that the distribution pattern of *Clytia volubilis* is considered to be influenced by the presence of *Obelia dichotoma*, that is the density of the former intends to decrease at the portion where the well developed colony of the latter species appears (Fig. 5).

As this fact gave an impression of the so-called interspecies coaction among hydrozoan species, namely inter-colonial coaction of various hydrozoan colonies, additional analysis was done to ascertain it.

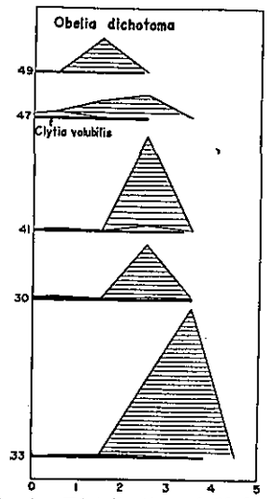

Fig. 6. Distribution of *Obelia dichotoma* on several branches. Numerals on ordinate shows ordinal number of examined branch.

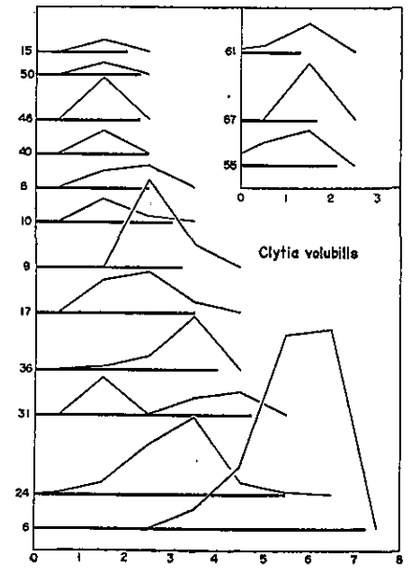

Fig. 7. Distribution of *Clytia volubilis* on branches. Numeral on ordinate shows ordinal number of examined branch.

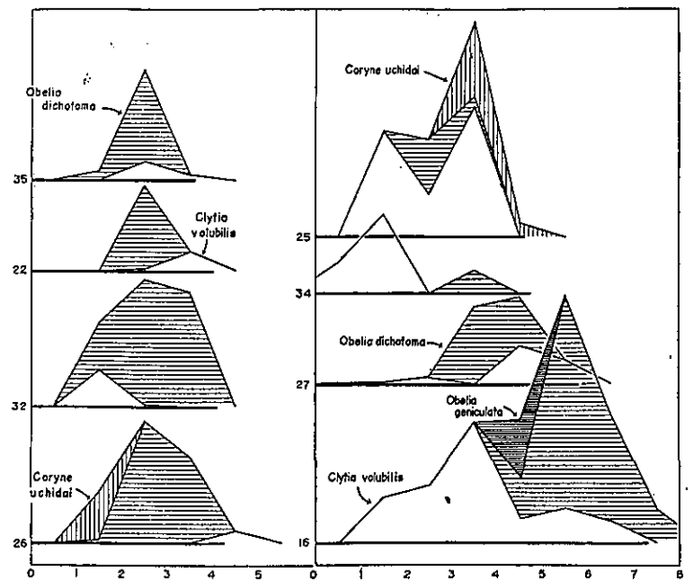

Fig. 8. Distribution of constituent species on several branches on which more than two species coexist. Numeral on ordinate shows ordinal number of examined branch.

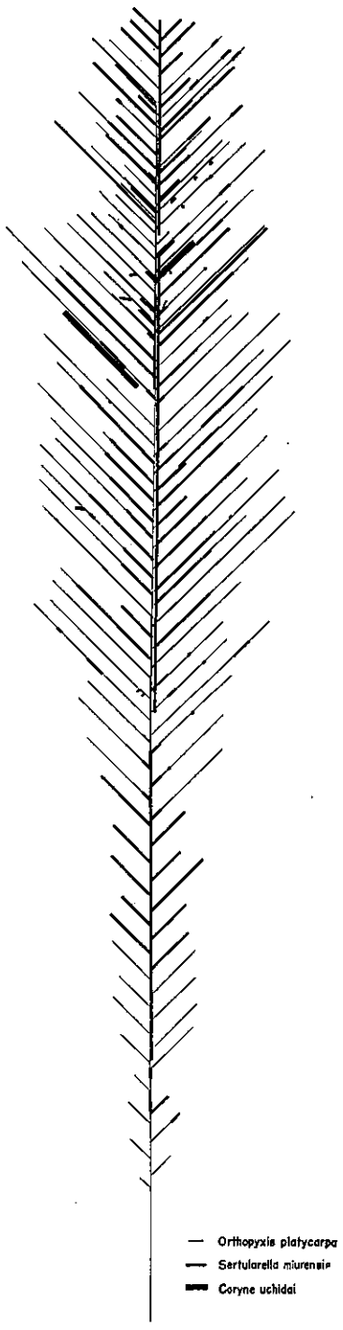

Fig. 9. Distribution patterns of hydrozoa on *Sargassum tortile*.

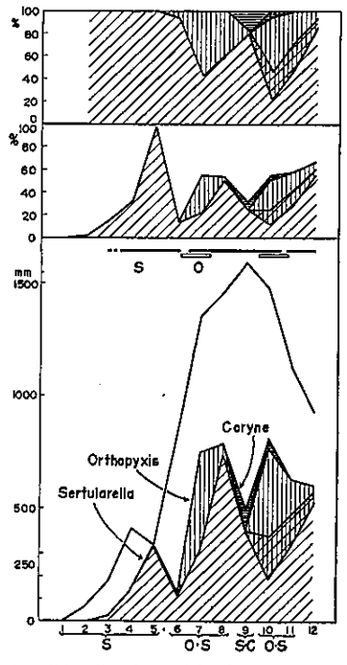

Fig. 10. Distribution of hydrozoa on *Sargassum tortile*. Total length of weed and of colonies of each species in each stratum are at the bottom : the rate of the colony length to the total length of the weed in each stratum is in the middle : at the top the relative value of each constituent species in each stratum is shown : bar shown in the middle represents the distributing range of the dominant species (shown by alphabetical letter) on the stem ; alphabetical letter on abscissa indicates the dominant species in each stratum of the plant.

As for the branches on which appears only one hydrozoan species, it is recognized that the hydroid colony of each species develops near the distal end of the branch, so the distributing mode is just the same in both species, *Obelia dichotoma* and *Clytia volubilis* (Figs. 6 & 7).

But the case is different in the branch on which the said two species coexist (Fig. 8). The distributing mode of *Obelia dichotoma* is the same as in the case when it monopolies one branch, appearing near the distal end of the branch, but *Clytia volubilis* inclines to shift its position from the said characteristic distal portion of the branch to a more distal or proximal position. Here, it is suggested that this shifting of the position of *Clytia* has resulted from the coexisting of two species, but the causality of this fact is yet unknown.

II. *Sargassum tortile* was collected from the sargassum community along the coast of Tsuchiya near Asamushi.

From the discoidal root a short but stout trunk arises and soon divides into several large main branches which seem to be comparable with the stem of the above mentioned *Sargassum* in regard to the inhabitation of hydrozoan species. In the present investigation one of these main branches was dealt with.

As is shown in Fig. 9 the vertically stratified arrangement is recognized among colonies of various hydrozoan species, namely the dominant species changes successively from the proximal to the distal end of the main branch.

In a main branch examined in the present work (Fig. 10) there are four strata in which the dominant species are from the proximal to the distal stratum respectively *Sertularella miurensis*, *Orthopyxis* sp. and *Sertularella*, *Sertularella* and *Coryne uchidai*, and *Orthopyxis* and *Sertularella*.

Since there are some subordinate branches in which two hydrozoan species coexist, it is very interesting to compare the colony size of one species which monopolies a subordinate branch with that coexisting with other species (Fig. 11).

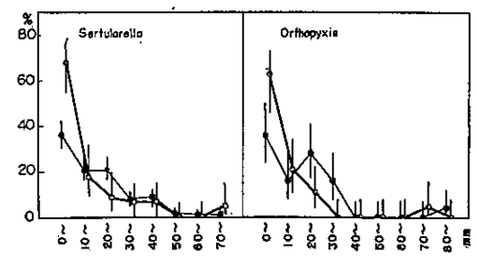

Fig. 11. Frequency distribution of various sizes of colonies of *Sertularella miurensis* and *Orthopyxis* sp. empty circle : the colony size when two sepcies coexist, solid circle : the colony size when only one species appears, bar : the confidence interval in 60 per cent reliability.

The colony of each species, especially in *Sertularella*, tends to become small when two species coexist on one subordinate branch and furthermore there is an indication that in *Orthopyxis* the density of the living hydranth becomes decreased.

CONCLUSION

The interspecies relation between hydrozoan species is supposed when they develop their colonies on the seaweeds. In the present observations, influenced by *Obelia dichotoma*, *Clytia volubilis* shifts its position from the normal location to the more distal or proximal situation of the branch, and in the case of *Sertularella* and *Orthopyxis*, each species has a tendency to decrease the colony size and the number of polyps in the latter tends to decrease when these two species develop their colonies in the same situation of the plant.

These so-called 'coaction' observed in the hydrozoan species seems to be in need of the further investigation both in the field and in the laboratory, and this will be dealt with at another opportunity by the present authors.

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